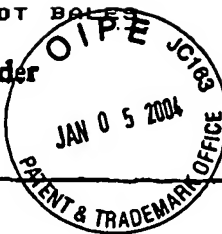




University of Colorado at Boulder



**JILA**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No. : 10/062,584  
Applicant : Backus et al  
Filed : February 2, 2002  
Title : Ultrashort Pulse Amplification in Cryogenically Cooled Amplifiers  
Group Art Unit : 2828  
Examiner : T. Nguyen  
Docket No. : C01.110

**Declaration Under 37 C.F.R. 1.132**

County of Boulder )  
State of Colorado )ss.

**Affiant, Henry C. Kapteyn, Ph.D., states as follows:**

**Affidavit of Henry C. Kapteyn, Ph.D.**

**I, Henry C. Kapteyn, being duly deposed and sworn, hereby state:**

1) That I have obtained a B.S. degree from Harvey Mudd College, an M.A. Degree from Princeton University, and a Ph.D. from the University of California at Berkeley, all in physics. My Ph.D. thesis work was in the area of laser physics and in-part dealt with high-power, ultrashort-pulse Ti:sapphire lasers.

2) I am well qualified as an expert in this field. I have been working in the area of Ti:sapphire lasers and laser amplifier systems since the late 1980's. The first paper I co-authored in this topic[1] was among the first papers that demonstrated the generation of high-power, femtosecond light pulses using solid-state laser media. Since then, I have published as a research group principal investigator extensively on various aspects of Ti:sapphire laser and laser-amplifier systems technology, with over two dozen papers specifically on Ti:sapphire laser technology that have been collectively cited more than 1000 times.[2-33] A recent 25 year retrospective of the journal Optics Letters, the premier rapid-publication journal covering this field,[34] found that I am one of the 25 most cited authors in this journal, primarily on the basis of my work in ultrashort-pulse



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ti:sapphire lasers and laser-amplifier systems.

3) That I am an inventor in the above-identified patent application.

4) That prior to making the present invention, it was not obvious to me or to my co-inventors that adding a cryogenic cooler to a laser amplifier would result in an improvement in the efficiency of pump light to laser light conversion. In my prior work and that of my co-inventors, we employed a cryogenically cooled crystal as the second, low-gain amplifier in a "two stage" amplifier design. We did this because we knew that the high-gain, first stage amplifier worked well without cryogenic cooling, and we thought that the overall performance and efficiency of the laser system would be optimized by splitting the pump laser power, using a bit of it for a first stage amplifier; and then "seeding" the second stage amplifier with a relatively high energy obtained from the first amplifier.

5) That when my co-inventors and I tried a single-stage cryogenically-cooled amplifier system, it was a surprising result that both high overall gain and high optical-to-optical conversion efficiency could be obtained in a single-stage laser. The fact that the advantages of this new configuration are not obvious is further evidenced by the long time-interval between the first work where we employed cryogenic cooling of a laser,[30] and the first work where we employed the single-stage, high-gain, high-efficiency, and high output power configuration that is the subject of this patent.[33] Since we have developed this new cryogenically-cooled configuration, we have been reconfiguring the several laser systems that we use in our research labs to the new single-stage cryocooled design.

6) That in my extensive knowledge of the literature in this area, including the prior art cited by the Examiner, no one before now has appreciated that both high overall gain and high optical-to-optical conversion efficiency to high-power pulses could be obtained in a single stage laser. Specifically, efficient single-stage cryo-cooled amplification from about  $10^{-9}$  Joules to about  $10^{-3}$  Joules, as claimed in claim 1 of the present patent amplification, has heretofore not been considered to be possible.

All statements made in the foregoing Affidavit which are from the Affiant's own knowledge are true and all statements made on information and belief are believed to be true.



HK.



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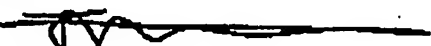
Further Affiant sayeth not.

Subscribed and sworn to before me this 5th Day of January, 2004

  
Notary Public

My Commission Expires 6/20/2005

Respectfully Submitted,

By   
Henry C. Kapteyn, Ph.D.

Dated January 5, 2004



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